A PROCESS FOR THE REMOVAL OF SO_2, HCN AND H_2S AND
OPTIONALLY COS, CS_2 AND NH_3 FROM A GAS STREAM

The invention relates to a process for removing SO_2,
HCN and H_2S and optionally COS, CS_2 and NH_3 from a gas
stream.

Gas streams from industrial chemical processes may
contain a variety of sulphur compounds such as H_2S, SO_2,
CS_2 and COS. The removal of these sulphur compounds is of
considerable importance, because the toxicity and smell
of sulphur compounds renders their presence highly
undesirable. In addition, other compounds whose presence
is undesirable may be present such as HCN or NH_3. It is
often necessary for the intended purposes of the gas
stream to remove these compounds at least partly, for
example to prevent catalyst poisoning in processes after
the gasification stage.

Processes for the removal of sulphur compounds are
known in the art.

In EP 324,526 a process is described for the removal
of H_2S, COS, CS_2 and SO_2 from a gas stream, by converting
COS and CS_2 into H_2S. Although EP 324,526 mentions the
removal of H_2S, it does not specify the preferred type of
process for H_2S removal, nor is the concentration of H_2S
in the treated gas stream mentioned.

A process known in the art for the removal of H_2S
from a gas stream is the partial oxidation of H_2S to SO_2
according to:

(1) Partial H_2S oxidation $2H_2S + 3O_2 \rightarrow 2H_2O + 2SO_2$

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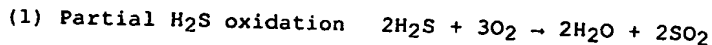
The SO_2 formed can be (catalytically) converted to elemental sulphur according to the Claus reaction:

(2) Claus reaction $4H_2S + 2SO_2 \longleftrightarrow 4H_2O + 3S_2$
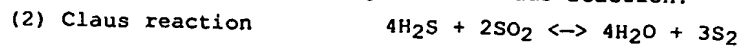
This process is known as the Claus process. The Claus
5   process is frequently employed both in refineries and for the processing of H_2S recovered from natural gas.

A disadvantage of the Claus process is that it is thermodynamically limited by the increase of the water vapour content and simultaneously by the decrease of the
10   H_2S and SO_2 concentration as the H_2S conversion proceeds, with the result that the equilibrium of the Claus reaction shifts to the left. Since the dew point of water lies below the solidification point of sulphur, condensation of the water vapour in the process gas to
15   remove this limitation can lead to serious problems, such as clogging due to the solidification of sulphur and corrosion due to the formation of sulfuric acid, causing serious operational problems.

At relatively low concentrations of H_2S, typically
20   concentrations below 20 vol%, the Claus process is difficult to operate and requires special technical provisions.

Another disadvantage of the Claus process is that the concentration of H_2S in the treated gas is still
25   relatively high. The Claus process has been improved to an extent where the H_2S content of the treated gas can be lowered to approximately 1 vol% (Superclaus-99 process) and the SO_2 content to approximately 0.02 vol%. However, especially in the case where it is necessary to comply
30   with requirements with regard to residential use or environmental regulations with respect to emission of sulphur compounds, even lower concentrations of H_2S and

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SO_2, in the ppm range, have to be achieved. A
disadvantage of the Claus and Superclaus process is that
such low concentrations of H_2S and SO_2 cannot be
achieved.

5   The removal of HCN from gas streams is important not
only because of its own toxic properties, but also in
view of corrosive NO_x compounds which can evolve when
both HCN and oxygen are present in a gas stream. In
addition, HCN itself is corrosive to equipment when
10   allowed to concentrate in liquid streams upon gas
treating.

We have now found a relatively simple and inexpensive
process for removing SO_2, H_2S and HCN and optionally COS,
CS_2 and NH_3 from a gas stream. In the process according
15   to the invention, a combination of reaction steps is used
to achieve the removal of sulphur compounds such as H_2S
and SO_2, and optionally also COS and/or CS_2, as well as
HCN from a gas stream comprising these compounds, to
concentrations of below 10 ppmv for H_2S, below 100 ppmv
20   for SO_2 and below 0.01 vol%, preferably 10 ppmv for HCN.

The invention relates to a process for the removal of
SO_2, HCN and H_2S and optionally one or more compounds
from the group of COS, CS_2 and NH_3 from a first gas
stream, which process comprises the steps of:
25   (a) removing SO_2 from the first gas stream by
contacting the first gas stream in a hydrogenation zone
with a hydrogenation catalyst in the presence of hydrogen
to obtain a second gas stream;
(b) removing HCN and optionally COS and/or CS_2 from the
30   second gas stream obtained in step (a) by contacting the
second gas stream in a hydrolysis zone with a hydrolysis

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catalyst in the presence of water to obtain a third gas
stream;

(c)   removing NH_3 from the third gas stream by
contacting the third gas stream in a NH_3-removal zone
with an aqueous (acidic) washing liquid to obtain an
ammonium-comprising aqueous stream and a fourth gas
stream;

(d)   removing H_2S from the fourth gas stream by
contacting the fourth gas stream in a H_2S-removal zone
with an aqueous alkaline washing liquid to obtain a H_2S-
depleted gas stream and a hydrogen-sulphide-comprising
aqueous stream;

(e)   contacting the hydrogen-sulphide-comprising aqueous
stream obtained in step (d) with sulphide-oxidizing
bacteria in the presence of oxygen in a oxidation reactor
to obtain a sulphur slurry and a regenerated aqueous
alkaline washing liquid;

(f)   separating at least part of the sulphur slurry
obtained in step (e) from the regenerated aqueous
alkaline washing liquid and;

(g)   recycling regenerated aqueous alkaline washing
liquid obtained in step (e) to the H_2S-removal zone in
step (d).

        In step (a) of the process according to the
invention, SO_2 is removed from the first gas stream by
contacting the first gas stream in a hydrogenation zone
with a hydrogenation catalyst in the presence of hydrogen
to obtain a second gas stream. In the hydrogenation zone,
SO_2 is converted to H_2S according to reaction (3):

(3) Hydrogenation reaction $SO_2 + 3H_2 \rightarrow H_2S + 2H_2O$

        Reference herein to a first gas stream is to a gas
stream comprising H_2S, SO_2, HCN and optionally one or

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more compounds selected from the group of COS, CS_2 and NH_3. The process is especially suitable for first gas streams having a total concentration of sulphur compounds, especially a total concentration of H_2S, of

5   between 10 ppmv and 30 vol%, preferably between 100 ppmv and 20 vol%, based on the total gas stream. At these relatively low concentrations of sulphur, especially of H_2S, conventional processes such as the Claus process cannot be operated without additional technical

10   provisions, for example amine treatment, to concentrate the H_2S content, whereas the process according to the invention can be operated without the need for additional technical provisions. Typically, the amount of H_2S in the first gas stream is at least 50% of the sulphur

15   compounds, preferably 80%, more preferably 90%.

Usually, the total concentration of HCN in the first gas stream is typically between 10 and 5000 ppmv, suitably between 20 and 1000 ppmv, or between 40 and 250 ppmv, based on the total gas stream.

20   Optionally, solid compounds present in the first gas stream can be removed from the first gas stream prior to entering the hydrogenation zone, for example by use of a filter. This results in less contamination of the sulphur product in step (e) of the process.

25   The hydrogenation zone can be a gas/solid contactor, preferably a fixed bed reactor. Suitable hydrogenation catalysts are for example cobalt/molybdenum, cobalt/tungsten or nickel/molybdenum catalysts. The hydrogenation catalysts suitable for the process

30   according to the invention can be supported, preferably on a refractory oxide support, more preferably on an alumina support.

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Suitably, the temperature in the hydrogenation zone
is between 200 °C and 380 °C, preferably between 210 °C
and 360 °C, more preferably between 250 °C and 350 °C,
still more preferably between 280 and 330 °C. It is found
5   that the hydrogenation reaction proceeds at favourable
rates at these temperature ranges. At a temperature range
of between 280 and 330 °C, the highest reduction of SO_2
is achieved. The pressure in the hydrogenation zone is
suitably between 1 and 100 bara, preferably between 2 and
10   80 bara.

The hydrogenation reaction results in the second gas
stream having a concentration of SO_2 below 100 ppmv,
preferably between 0.001 ppmv and 100 ppmv, more
preferably between 0.01 ppmv and 50 ppmv, suitably
15   between 0.1 ppmv and 15 ppmv, especially between 0.5 ppmv
and 10 ppmv, based on the total gas stream.

In step (b) of the process according to the
invention, HCN and optionally COS and/or CS_2 are removed
from the second gas stream obtained in step (a) by
20   contacting the second gas stream in a hydrolysis zone
with a hydrolysis catalyst to obtain a third gas stream.

In the hydrolysis zone, HCN and, if applicable, COS
and/or CS_2 are converted according to the following
reactions:

25   (4) Hydrolysis of HCN: $HCN + H_2O \rightarrow NH_3 + CO$
       (5) Hydrolysis of COS: $COS + H_2O \rightarrow H_2S + CO_2$
       (6) Hydrolysis of CS_2: $CS_2 + 2H_2O \rightarrow 2H_2S + CO_2$

The amount of water/steam in the hydrolysis zone is
preferably between 10 v/v% and 80 v/v%, more preferably
30   between 20 v/v% and 70 v/v%, still more preferably
between 30 v/v% and 50 v/v%, based on steam. At the
preferred water/steam amounts, the conversion of HCN and

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optionally COS and/or CS_2 is better. Typically, the amount of H_2O in the gas stream is sufficient to achieve conversion of HCN optionally COS and/or CS_2. Optionally, water or steam of a mixture thereof may be added to the second gas stream prior to contacting the second gas stream with the hydrogenation catalyst, in order to achieve the desired water/steam amount. Optionally, the reaction conditions are selected in such a way, that the reaction mixture remains below the dewpoint of H_2O. The H_2O in the gas stream can then advantageously be used for the conversion of HCN and optionally COS and/or CS_2, to the desired levels.

If COS and/or CS_2 are present, the total concentration of COS and CS_2 in the second gas stream is suitably between 10 ppmv and 2 vol%, preferably between 20 ppmv and 1 vol%, based on the total gas stream.

The hydrolysis zone can be a gas/solid contactor, preferably a fixed bed reactor.

Catalysts for the hydrolysis of HCN and optionally COS and/or CS_2 are known to those skilled in the art and include for example TiO_2-based catalysts or catalysts based on alumina and/or chromium-oxide. Preferred catalysts are TiO_2-based catalysts.

Optionally, the hydrolysis step can be done prior to the hydrogenation step. A disadvantage of performing the hydrogenation step prior to the hydrolysis step is that when a TiO_2 catalyst is used, the TiO_2 catalyst can also catalyze the Claus reaction, leading to the formation of sulphur from H_2S and SO_2. However, in the case where the temperature is above the dew point of sulphur, the formation of sulphur from the Claus reaction does not lead to clogging.

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The hydrolysis results in a third gas stream having a concentration of HCN below 0.01 vol%, suitably between 0.1 ppmv and 0.01 vol%, preferably between 1 ppmv and 50 ppmv, based on the total gas stream.

The concentration of COS, if present, in the third gas stream is below 0.01 vol%, suitably between 10 ppmv and 0.01 vol%, preferably between 15 ppmv and 100 ppmv, based on the total gas stream.

The concentration of CS_2, if present, in the third gas stream is below 0.01 vol%, suitably between 1 ppmv and 0.01 vol%, preferably between 2 ppmv and 50 ppmv, based on the total gas stream.

In step (c) of the process according to the invention NH_3 is removed from the third gas stream by contacting the third gas stream in an NH_3-removal zone with an aqueous (acidic) washing liquid to obtain an ammonium-comprising aqueous stream and a fourth gas stream. The process is especially suitable for a third gas stream having an amount of NH_3 of between 10 and 6000 ppmv, preferably between 20 and 2000 ppmv. The temperature in the NH_3-removal zone is suitably between 5 and 70 °C, preferably between 10 and 50 °C, to achieve a sufficient removal of NH_3 at a low temperature. The pressure in the NH_3-removal zone is suitably between 1 and 100 bara, preferably between 2 and 80 bara, to achieve a sufficient removal of NH_3 at a low pressure.

In step (d) of the process according to the invention H_2S is removed from the fourth gas stream by contacting the fourth gas stream in H_2S-removal zone with an aqueous alkaline washing liquid to obtain a H_2S-depleted gas stream and a hydrogen-sulphide-comprising aqueous stream.
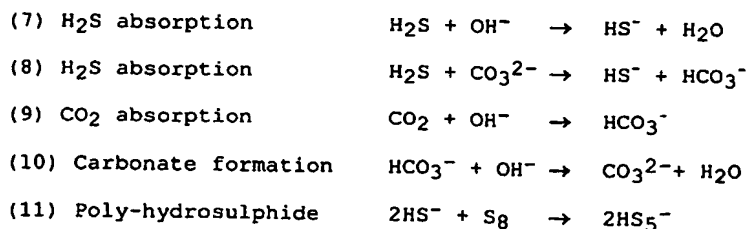
The process is especially suitable if the load of

sulphur compounds in the H_2S-removal zone is below 60000 kg/day, suitably between 50 and 50000 kg/day, preferably between 75 and 20000 kg/day, more preferably between 100 and 10000 kg/day. At these sulphur loads,
5 conventional processes such as the Claus process are difficult, if not impossible, to operate, whereas the process according to the invention can be used advantageously.

Suitably, the total amount of H_2S of the fourth gas
10 stream is between 10 ppmv and 20 vol%, preferably between 20 ppmv and 10 vol%. An advantage of the process according to the invention is that the H_2S in the fourth gas stream can be removed even when the H_2S amount is relatively low, typically between 10 ppmv and 20 vol%.
15 For other processes such as the Claus process it is necessary that a sour gas is produced that has a high H_2S content to make it suitable as a Claus feed, for example by an amine treatment and regeneration step prior to the Claus reaction.
20 Suitable aqueous washing liquids include aqueous hydroxide solutions, e.g. sodium hydroxide or potassium hydroxide solutions in water. The pH of the aqueous alkaline solvents is suitably between 7 and 12, preferably between 8 and 11.
25 The main reactions that can take place in the H_2S-removal zone in step (d) are:

(7) H_2S absorption $H_2S + OH^- \rightarrow HS^- + H_2O$

(8) H_2S absorption $H_2S + CO_3^{2-} \rightarrow HS^- + HCO_3^-$

(9) CO_2 absorption $CO_2 + OH^- \rightarrow HCO_3^-$

30 (10) Carbonate formation $HCO_3^- + OH^- \rightarrow CO_3^{2-} + H_2O$

(11) Poly-hydrosulphide $2HS^- + S_8 \rightarrow 2HS_5^-$

formation

The term sulphide-comprising aqueous stream as used
herein refers to an aqueous stream comprising one or more
products of the main reactions (7) to (11) that can take
place in the H_2S-removal zone, such as HS^-, disulphides,
polysulphides, thiocarbonates and carbonates but can also
include dissolved H_2S.

The preferred temperature in the H_2S removal zone is
between 5 and 70 °C, more preferably between 10 and
50 °C. Preferably, the pressure in the H_2S removal zone
is between 1 and 100 bara, more preferably between 2 and
80 bara.

Typically, the H_2S removal zone is a gas/liquid
contactor. Suitable gas/liquid contactors are described
in Perry's Chemical Engineers' Handbook, 7th edition,
section 14 (1997) and include for example a tray or ·
packed column or a gas scrubber.

Optionally, the medium of the H_2S removal zone is
buffered. Preferred buffering compounds are carbonates,
bicarbonates phosphates and mixtures thereof, especially
sodium carbonate and/or sodium bicarbonate. The
concentration of the buffering compounds depends inter
alia on the composition of the gas flow and is generally
adjusted in such a way, that the pH of the reaction
medium in the H_2S removal zone is between 6.0 and 10,
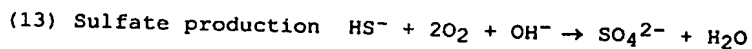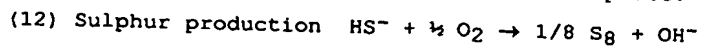more preferably between 6.5 and 9.0.

Optionally, fresh alkaline washing liquid can be
supplied to the H_2S removal zone to achieve the desired
pH.

Due to their odorous nature, H_2S, mercaptans,
sulphides, disulphides and aromatic mercaptans can be
detected at parts per million concentrations. Thus, it is

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desirable for users of such gas and refinery streams to
have total concentration of sulphur compounds, especially
H_2S, lowered to a concentration of e.g. less than 30 or
20 ppmv, preferably less than 10 ppmv, based on the total
5   H_2S-depleted gas stream.

The process results in a "H_2S-depleted gas stream"
having a total concentration of sulphur compounds,
especially H_2S, of below 35 ppmv, suitably between 0.01
and 30 ppmv, or below 25 ppmv, suitably between 0.01 and
10   20 ppmv, or below 15 ppmv, suitably between 0.01 and
10 ppmv, preferably between 0.05 and 3.5 ppmv, more
preferably between 0.1 and 1 ppmv, based on the total gas
stream.

In step (e) of the process according to the invention
15   the hydrogen-sulphide-comprising aqueous stream obtained
in step (d) is contacted with sulphide-oxidizing bacteria
in the presence of oxygen in a oxidation reactor to
obtain a sulphur slurry and a regenerated aqueous
alkaline washing liquid. The main reaction that can take
20   place in the oxidation reactor in step (e) is the
microbiological formation of sulphur and sulphate:

(12) Sulphur production $HS^- + \frac{1}{2} O_2 \rightarrow 1/8\ S_8 + OH^-$

(13) Sulfate production $HS^- + 2O_2 + OH^- \rightarrow SO_4^{2-} + H_2O$

The term sulphur slurry as used herein refers to a
25   slurry comprising one or more products of the main
reactions, including reactions (12) and (13), that can
take place in the oxidation reactor.

The term regenerated aqueous alkaline solvent as used
herein refers to an aqueous alkaline solvent wherein at
30   most 2 w/w% sulphur particles are present, preferably at
most 1 w/w%.

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The amount of oxygen fed into the oxidation reactor is adjusted such that the oxidation of absorbed sulphide results predominantly in sulphur, as suggested in NL 8801009, disclosing a process for the controlled
5   oxidation of sulphur-containing waste water.

Reference herein to sulphide-oxidizing bacteria is to bacteria which can oxidize sulphide to elemental sulphur. Suitable sulphide-oxidizing bacteria can be selected for instance from the known auto tropic aerobic cultures of
10   the genera Thiobacillus and Thiomicrospira.

Typical pressures in the oxidation reactor in step (e) are between 1 and 2 bara.

Suitably, the oxidation reactor has a volume of between 5 and 2500 m^3, preferably between 10 and 2000 m^3.
15   Preferably, the reaction medium in the oxidation reactor in step (e) is buffered. The buffering compounds are chosen in such a way that the bacteria present in the oxidation reactor tolerate them. Preferred buffering compounds are carbonates, bicarbonates phosphates and
20   mixtures thereof, especially sodium carbonate and/or sodium bicarbonate. The concentration of the buffering compounds depends inter alia on the composition of the gas flow and is generally adjusted in such a way, that the pH of the reaction medium in the oxidation reactor is
25   between 6 and 10, more preferably between 7 and 9.

In step (f) of the process according to the invention at least part, typically between 5 and 95 w/w%, preferably between 10 and 90 w/w% based on the total weight of the slurry, of the sulphur slurry obtained in
30   step (e) is separated from the regenerated aqueous alkaline solvent. The phrase "at least part of" as used herein also includes a complete separation of sulphur from the regenerated aqueous alkaline liquid.

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Suitably, the separating step takes place in a solid/liquid separator. Suitable solid/liquid separators are described in Perry's Chemical Engineers' Handbook, 7th edition, section 22 (1997).

5   Typically, the sulphur content of the separated aqueous sulphur slurry is between 5 w/w% and 50 w/w%, based on the slurry. Typically, the water of the sulphur slurry is removed to an extent that a sulphur cake with a dry solids content of between 55 and 70% is obtained.

10   Typically, the sulphur content of the sulphur cake is between 90 and 98 w/w%, based on the total weight of the sulphur cake. Optionally, the sulphur slurry obtained in step (c) can be re-slurried, filtered and dried to obtain a sulphur paste with a purity of at least 95 wt% sulphur,

15   preferably at least 99 wt% sulphur. The sulphur paste thus-obtained can optionally be dried to produce a powder with a dry weight content of at least 85%, preferably at least 90%. This powder can suitably be applied as a fungicide or as a miticide.

20   The sulphur produced in the process according to the invention has a hydrophilic nature and does not cause the fouling problems that are typically caused by sulphur produced by non-biological liquid processes. Another advantage of the sulphur produced in the process

25   according to the invention is that it is very suitable for use as a fertilizer.

In step (g) of the process according to the invention, regenerated aqueous alkaline washing liquid obtained in step (e) is recycled to the H_2S-removal zone

30   in step (d). Suitably, between 10 and 99%, preferably between 30 and 95%, more preferably between 40 and 90% of the total amount of regenerated aqueous alkaline washing liquid obtained in step (e) is recycled to the

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H_2S-removal zone in step (d). By recycling the
regenerated aqueous washing liquid to the H_2S-removal
zone fresh aqueous washing liquid is supplied to the
H_2S-removal zone for the removal of H_2S. This enhances

5   the removal of H_2S to a concentration of 30 ppmv or less,
suitably 20 ppmv or less, preferably 10 ppmv or less. The
regenerated aqueous alkaline washing liquid optionally
comprises sulphur particles.

        The process according to the invention is especially

10   suitable for the treatment of a gaseous CO-containing
stream, especially a syngas stream, an offgas stream from
a carbon black plant, or a refinery gas stream. Syngas is
a general term that is applied to mixtures of carbon
monoxide, hydrogen, inert components and, carbon dioxide

15   that are derived from the gasification of coal, oil
residues, waste or biomass. The main components of syngas
are hydrogen and carbon monoxide. Further, often carbon
dioxide and traces of methane are present. Refinery
streams concern crude oil derived gaseous streams

20   containing smaller or larger amounts of sulphur
compounds. Recycle streams and bleed streams of
hydrotreatment processes, especially hydrodesulfurisation
processes, can also suitably be treated by the process
according to the invention.

25   The invention will now be illustrated by means of
schematic figure 1. Figure 1 depicts a typical process
scheme according to the invention, wherein a gas stream
comprising SO_2, HCN, H_2S and optionally COS, CS_2 and NH_3
enters via line (1) the hydrogenation zone (2) via

30   line (1) and is contacted with the hydrogenation catalyst
to remove the SO_2. Hydrogen is supplied to the
hydrogenation zone via line (3). After treatment in the
hydrogenation zone the second gas stream, which is

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SO_2-depleted, leaves the hydrogenation zone via line (4)
and enters the hydrolysis zone (5) where it is contacted
with a hydrolysis catalyst to remove HCN and optionally
COS and/or CS_2. Optionally, steam or a steam/water

5   mixture can be added to the hydrolysis zone via line (6).
After treatment in the hydrolysis zone, the third gas
stream, which is depleted of HCN, COS and/or CS_2, leaves
the hydrolysis zone via line (7) and enters the HN_3-
removal zone (8), where it is treated with aqueous

10   (acidic) washing liquid to obtain an ammonium-comprising
aqueous stream and a fourth gas stream. Optionally, steam
or a steam/water mixture can be added to the HN_3-removal
zone via line (9). After treatment in the NH_3-removal
zone, the fourth gas stream, which is depleted of HCN,

15   COS and/or CS_2 and NH_3, leaves the HN_3-removal zone via
line (10) and enters the H_2S-removal zone (11), where it
is contacted with an aqueous washing liquid. The H_2S-
depleted gas stream is led from the H_2S-removal zone via
line (12), optionally via a knockout vessel (13) and can

20   be further processed via line (14). A sulphide-comprising
aqueous stream leaves the H_2S-removal zone via line (15)
and enters a flash vessel (16). H_2S-depleted excess gas
is vented off from the flash vessel through line (17). In
the case that flash gas contains some H_2S, the H_2S is

25   removed in a small flash gas contactor before further use
as fuel gas. The sulphide-comprising aqueous stream is
led via line (18) to the aerobic reactor (19) where the
sulphide compounds are oxidized. Nutrients and air are
fed to the aerobic reactor via feed lines (20) and (21).

30   The sulphur-containing solid/liquid mixture generated in
the aerobic reactor is led via line (22) to a
solid/liquid separator (23) where the sulphur-slurry is

separated and discharged via line (24). The liquid is led
back to the bioreactor via line (25). Off-gas is vented
from the aerobic reactor via line (26). The regenerated
aqueous alkaline solvent is led to the H_2S-removal zone
5   via line (27).

The invention will now be illustrated by the
following non-limiting examples.

EXAMPLE 1 (comparative)

A gas stream containing sulphur- compounds and HCN
10   with concentrations as given in table 1 is heated to a
temperature of 280 °C and led to a reactor filled with a
stacked bed of hydrogenation catalyst and hydrolysis
catalyst. The gas is cooled in a quench tower at 40 °C
and treated in an amine/Claus unit to remove the H_2S. The
15   concentrations of sulphur compounds and of HCN in the
treated gas is given in table 1.

Table 1

	Gas to treating system (v/v%)	Gas after treating system (v/v%)
H_2O	6.7	3.2
H_2S	1.9	0.01
SO_2	0.1	0.05
CS_2	0.09	0.01
COS	0.28	0.01
HCN	0.03	0.01
NH_3	0.04	0.03

EXAMPLE 2 (according to the invention)

A first gas stream containing sulphur- compounds, NH_3
and HCN with concentrations as given in table 2 is heated
20   to a temperature of 280 °C and led to a reactor filled

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with a stacked bed of hydrogenation catalyst and
hydrolysis catalyst to create a second gas stream and
subsequently a third gas stream. The third gas stream is
cooled in a quench tower at 40 °C and treated in an NH_3-
5 scrubber to create a fourth gas stream. The fourth gas
stream is treated in a H_2S-removal unit to create a H_2S-
depleted gas stream. The resulting hydrogensulphides are
oxidised in a bioreactor. The concentrations of the
sulphur-containing compounds and of the HCN in the
10 treated gas (H_2S-depleted gas) are given in table 2.

Table 2

	Gas to treating system (first gas stream) (v/v%)	Gas after treating system (H_2S-depleted gas stream) (v/v%)
H_2O	40	6.8
H_2S	0.9	0.0002
SO_2	0.1	0.001
CS_2	0.04	0.0002
COS	0.01	0.001
HCN	0.1	0.001
NH_3	0.03	0.001

From the examples it is clear that with the process
according to the invention a substantially lower
concentration of sulphur-containing compounds, especially
of H_2S, SO_2, CS_2 and COS is achieved, while the
15 concentration of NH_3 and HCN is also lowered.